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ABSTRACT

This paper describes a collaborative research project conducted by two first grade teachers. The project focuses on the use of hands-on science activities and the relationship between a teacher and a mentor teacher. An integrated curriculum with science as the central theme is employed and further developed through the joint efforts of the two teachers. Data collected consisted of student interviews, a student survey, and student science journals. Findings contribute to an understanding of oral language ability versus written language ability, the effect of an inadequate scientific vocabulary on science learning, and the various paths taken to achieve a correct answer. (DDR)

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Umm... I Think.....

Student Formulated Conclusions to Science Activities

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Paper presented at the Annual Meeting of the National Association for Research in Science Teaching, San Diego, CA, April 20, 1998

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ABSTRACT

This research paper involves two first grade classrooms. The goal was for all students to formulate and state their own conclusions. Each classroom participated in hands-on experiments. Most students were able to summarize their findings in their science journals.

INTRODUCTION

This school year 1996-97 began with both of us teaching self contained first grade classrooms. I, Cindy Kight was interested in using a different approach of whole language and a science integrated curriculum. I asked Naomi Mayer for guidance and she became my mentor. In the first half of the school year, I was one week behind Naomi in lesson plans. This allowed for the development of the curriculum and internalization of the "big picture."

I, Naomi Mayer have been teaching an integrated curriculum without basal readers for 15 years. This is the first year I have used science as the encompassing theme for the whole curriculum. Working as a mentor teacher has been thought provoking as I reflect daily on my purpose, setting and outcome for each lesson. Our planning has been a collaborative effort. The curriculum was enhanced with the input of two teachers. This partnership has been a positive learning experience for both of us.

We believe that children need to learn in a manner that is logical. It is necessary for the curriculum to be authentic and meaningful. Children are enthusiastic about learning of the world around them. Lifelong scientific literacy begins with the attitudes and values established in a child's earliest years. It is important to spark each child with the joy and wonder of science. We chose a theme for the entire school year. This year we chose the tree and all of our learning units correspond and intertwine with it. The first week of school we made the tree with cardboard boxes and tubes. Our tree goes through the seasonal changes and is inhabited by a variety of animal life.

Each month we focus on a unit that is tied into the tree. In September we learned about tree growth, bearing fruit and changing leaves in autumn. In October, we learned about bears (many of who live in trees) and the bees whose honey the bears eat. We also learned about spiders who build their webs in trees and compared insects to arachnids. In November, we studied the Native American Indians through legends that pertained to trees and nature. In December, we studied the Christmas tree (deciduous trees) and the different customs celebrated around the world. In January, we are studying the tree and winter (the effects of snow and ice). In February, we will learn about the seed. In March and April, we will understand the seasonal changes spring brings, the water cycle and its effect on new growth.

Our research was conducted during this time. The scientific hands-on activities that the children experienced dealt with the concepts of rain and the water cycle. Science is integrated into the curriculum throughout the day. The scientific process is part of everyday application. The students make a hypothesis, describe objects and events, are encouraged to ask questions, acquire new knowledge, construct explanations of

occurrences, test their explanations, and communicate their ideas to others. Children are encouraged to establish connections between their current knowledge of science and new found learning and then apply this to new questions. Each activity encourages problem solving, planning, decision making and group interactions.

Starting in January, we introduced science journals to produce accountability and compile data. The student's science journals are looked at each day for clarity of recording procedure, data and the understanding of concepts covered. This enabled ease of assessment and evaluation of each child's progress. For each experiment, there is a question with which to form a hypothesis. The materials necessary are recorded by words and drawings. Each step of the experiment and the results are documented with words and pictures as well. At the end of each experiment, a conclusion and explanation of the occurrence summarizes new found knowledge and concepts.

We questioned whether or not our first grade students were clearly understanding the science concepts introduced. As teachers, we were summarizing each experiment for our students. We felt that our students had the necessary language arts skills to successfully formulate and write their own conclusions; conveying their understanding of the concept.

We felt that if the students observed and articulated the "why," their learning would be more meaningful and life long. As early childhood educators, we know that if a child uses their own words and ideas to create their own conclusion it becomes authentic.

PROCEDURE

Setting:

This research project was conducted at Sollars Elementary School on Misawa Air Base, Japan. We have a student population of 1,200. Most of our students are from military families although a few families are civilian employees. In our first grade classrooms, we have 24 students. Each of our classrooms has more girls than boys. Our students are six and seven years of age. We have a class of average ability with inquisitive minds and eager participators. In each class, we have two E.S.L. students.

Design:

Our unit was springtime and focused on the rain and the water cycle. We designed experiments to teach these concepts. The question was what shape is a raindrop when it hits the ground? The materials were a container filled with flour, an eyedropper and water. The children worked in pairs. First, they made their hypothesis. Then they took turns and dropped drops of water into the flour. Each pair records the results in their science journal. After writing their conclusion, the children had the question of whether the shape of the raindrop would change if the height of the release was different.

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The following day the children answered this question. A ruler was added to the materials used in the first experiment. First, the drop was released from 12 inches above the table. A drop of water was then released from a standing position. The children recorded the results and stated their own conclusions.

In order to expand the experience, we designed an additional experiment. Using three different size eyedroppers, we conducted the same experiment. There were two questions: "Will the size of the raindrop change?" and "Will the shape of the raindrop change?" The results were recorded in the science journals and the conclusions were stated.

The focus of the second set of experiments was the water cycle. We set up the experiment with two glasses of water with no cover. We colored the water with food coloring. The blue water cup was placed in the sun. The yellow water cup is placed in the shade. The question was "What will happen to the water?" The children wrote their hypothesis. We checked the water level after three days.

The following experiment asked the same question. The materials used and the procedures were different. We used a cup, water, food coloring and a zip-loc bag. We put the cups filled with water in a zip-loc bag and put the cups in the sun. After three days, we checked the water level.

Each experiment was recorded in the children's science journals. They are a collection of ideas and give us focus and direction. A copy of the journal set up is included in our appendix.

Data Sources:

The data collected during this research project includes interviews by each teacher with two typical first graders. One student was a girl while the other was a boy. The students interviewed were the same ones for each experiment.

The science journals provided the opportunity for each teacher to access and assess changes in children's understandings and thinking, identify misconceptions, and provide a more complete picture of children's understandings of science phenomena (Dana, Lorsbach, Hook, and Briscoe, 1991).

A survey to evaluate understanding of concepts previously covered was given to all students in each classroom. Two of the questions included results of experiments that the teacher summarized for the class. The other two questions dealt with experiments where the students formulated and stated their own conclusions. Lastly, we inquired about each child's attitude and opinion towards science.

OUR FINDINGS

1. *Oral Language Ability vs. Written Language Ability*

For each experiment, there were children who showed difficulty summarizing their results and recording it in their journal. When questioned about their understanding by the teacher, the child was able to verbalize the correct conclusion.

John's journal conclusion of the evaporation of the water in the cup: *Less water.*
The teacher asked John what happened to the water. John replied, "The water evaporated into the air."

Jeff's journal conclusion of the water cycle: *The water came back.*
The teacher asked Jeff what happened to the water. Jeff replied, "The water in the cup is the same because it came back just like in the water cycle."

2. *Seeking the Correct Answer*

Several children showed frustration because their written language capabilities and the fear of being wrong inhibited their ability to risk expressing their own ideas and conclusions.

Sally's journal conclusion of the shape of a raindrop: *I don't know.*
She started to cry when prompted to write any conclusion.

Sarah's journal conclusion of the water cycle: *blank*
She crumpled the page when she could not write the correct conclusion.

3. *Inadequate Scientific Vocabulary*

Even though a child knew the conclusion, the child could not express in the written form the scientific term for the results.

Sam's journal conclusion of the evaporation of water placed in the sun: *The sun sucked up the water.*

Joshua's journal conclusion of the water cycle: *It is like a basketball. It goes up and down. The sun is the hoop and the basketball is water. It bounces up and comes back down.*

Christian's journal conclusion of the evaporation of water placed in the sun: *It jumped out of the cup.*

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4. Conceptual Change

We found that a series of activities challenges the student's conceptions and leads them to a more scientifically acceptable understanding of the concept. For example, when we finished the first experiment on evaporation, many children understood evaporation as a magical phenomenon. The subsequent experiment was a cup of water sealed in a zip-loc plastic bag. This allowed the students to observe the actual water cycle. Their understanding was clearly recorded in their science journals.

CONCLUSION

Most of the students were able to demonstrate the proper punctuation, spelling, and vocabulary to formulate their own conclusion. However, some children were not developmentally capable of expressing themselves in the written English language. Their written language ability at this time is still in the pictorial stage. Others are comfortable only using patterned sentences. When asked to verbalize their conclusions, they show understanding of the concept. We found that interviews with the children were important to check for understanding of the science conceptions. To only rely on their written statements would give an incorrect picture of their understanding.

Ninety six percent of each classroom was unafraid to venture out and conclude using their own words in their journal. These children incorporate the use of "inventive" spelling and creative thinking. Four percent of the children were hesitant and even refused to state in their journal a conclusion. The fear of being wrong overwhelmed their abilities. The lack of self-esteem and the need for perfection was the cause of their frustration.

When the students did the first experiments, each teacher had not taught the scientific concept through the curriculum. Each child stated their conclusion using their own vocabulary. As the unit progressed, literature was introduced that provided the class with the necessary scientific terms for their results. The literature enabled the students to express their findings by incorporating scientific vocabulary in their statements.

Our first experiment on the shape of raindrops caused the students to ask additional questions. This allowed for supplementary experiments. We tested different variables effect on the shape of the raindrop. The children changed the height of the drop and the size of the eyedropper. The results of all the experiments enabled the students to draw the conclusion that the shape of a raindrop was circular. A similar thing occurred with the experiments on evaporation and the water cycle. Many children attributed the evaporation of water from a cup in the sun to magic! The subsequent experiment with the cup of water in a plastic bag actually explained the cycle of evaporation. We found that in order for the students to formulate and state their own conclusions it was necessary to provide more than one experience with the same concept.

IMPLICATIONS FOR FUTURE INSTRUCTION

Next school year, we plan to introduce science journals in September. The recording of data and conclusions will be initially pictorial. The next stage in development is single words and/or labeling. Patterned sentences follow in the developmental stages of writing. Finally, the students will be ready to write their conclusions using their own words. This progression of writing is consistent with the student's age development as well as the levels seen their creative writing journals.

Addressing the "correct answer" syndrome, we plan to expose the children to opportunities to share their ideas without the fear of rejection. At the start of the school year, a variety of experiences and activities will be implemented that do not require a correct answer. We will reinforce a positive self esteem and the attitude of risk taking.

Using the science curriculum as a driving force for the other subject areas was extremely successful. We found literature appropriate to the reading level and was able to incorporate many writing activities. Science as an encompassing theme will definitely be a focus next year.

REFERENCES

Shepardson,, Daniel P. and Britsch, Susan J. (February, 1997) **Children's Science Journals: Tools for Teaching, Learning, and Assessing.** Science and Children.

3/26

1

2 small

3 medium

4 big

Q: Is the Size different? yes
Q: Is the Shape different? No
C: The Size was different but the shape was the same circle.
W: There are different Size raindrops but the same shape.

In this experiment, Carol used three different eyedroppers. She recorded her materials in box 1, recorded the data of the small eyedropper in box 2, medium eyedropper in box 3, and large eyedropper in box 4. Q. stands for question and the hypothesis follows. C stands for conclusion and W is for why.

4/15

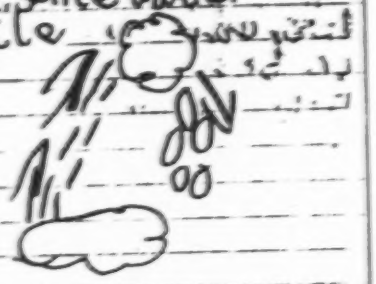
1

2

3 purple

4

What will happen to the water?
Same water C: Same water
W: water Cycle



In this experiment, Carol observed the water cycle. Box 1 shows the materials, box 2 shows the pouring of the water and food colorings into the cup and box 3 shows the cup being put into a zip-loc bag. Box 4 records the results 3 days later. Carol wrote the conclusion and the why in her science journal.

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